New Buildings Energy Performance Improvement through Incorporation of New Proven Technologies into Standard Designs

Standard Design for TEMF

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Industrial Process and Energy Optimization
Industry Workshop
Gettysburg, Pa
February 25, 2004

Report Documentation Page

Form Approved
OMB No. 0704-0188

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1. REPORT DATE **25 FEB 2004**	2. REPORT TYPE **N/A**	3. DATES COVERED -
4. TITLE AND SUBTITLE **New Buildings Energy Performance Improvement through Incorporation of New Proven Technologies into Standard Designs**		5a. CONTRACT NUMBER 5b. GRANT NUMBER 5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)		5d. PROJECT NUMBER 5e. TASK NUMBER 5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **ERDC-CERL, Energy Branch**		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S) 11. SPONSOR/MONITOR'S REPORT NUMBER(S)
12. DISTRIBUTION/AVAILABILITY STATEMENT **Approved for public release, distribution unlimited**		
13. SUPPLEMENTARY NOTES **See also ADM001865, Industrial Process and Energy Optimization. Proceedings of the Industry Workshop Held in Gettysburg, PA, 25-27 February 2004., The original document contains color images.**		
14. ABSTRACT		
15. SUBJECT TERMS		

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**22**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Issues

- Current Army Standard Designs don't specify potential energy saving and sustainable design opportunities, available energy saving technologies, and technologies resulting in better indoor air quality and thermal comfort;
- Building envelope, its elements and energy/ventilation systems are not optimized for heating/cooling loads reduction;
- Standard Designs require significant engineering efforts and budget for its application to each specific site and its optimization for efficient energy performance in the given climate…inconsistently applied by variety of A/E firms and there is no USACE process to police A/Es

Objectives

- Provide an opportunity for improved building energy performance, indoor air quality and thermal environment by incorporating different building, process and energy systems related measures into the Standard Designs;
- Insure Standard Design SPiRiT rating at, at least, Silver level (with a potential for a Golden level when applied to a specific design);
- Insure, that proposed measures have a three to five years or less pay-back period.

Methodology

- Develop methodology for building energy and security optimization;
- Select modeling and simulation tools and technologies screening procedure;
- Select representative Standard Design (e.g., Tactical Equipment Facilities) for the pilot analysis;
- Analyze current Standard Designs and evaluate opportunities for improved building energy performance and security, indoor air quality and occupants thermal environment;

Methodology (Continued)

- Produce a list of building, process and system related measures for further consideration;
- Select and get consensus on representative climatic conditions, and energy costs;
- Using simulation tools, e.g., Energy Plus, DOE-2, FEDS, LCCA, etc., screen the proposed technologies and measures for the appropriate performance and a pay-back period in representative climatic conditions;
- Incorporate changes into Standard Design.

Examples of Representative Climates/Locations/Energy Rates

Location	Climate	Cost of Energy	
		Electricity $/kWh	Natural Gas,$/MBtu
Ft. Wainwright	Arctic winter/mild summer	.1048	2.88
Ft. Drum	Cold winter/mild summer	.0681	5.75
Ft. Carson	Cold winter/hot-dry summer	.0441	4.04
Ft. Lewis	Maritime	.0357	6.98
Ft. Campbell	Moderate winter/Hot-humid summer	.0492	5.12
Ft. Bliss	Mild winters/Hot –dry summer	.0800	4.18
Ft. Bragg	Mild Winter/Hot-humid summer	.0455	4.54

The methodology can be applied to any or all Standard Designs.

USACE suggested the Standard Design for Tactical Equipment Maintenance Facilities can be used to test the concept.

Scope of Work for TEMF Standard Design

Phase 1 (8 weeks)

- Analyze current 1996 Standard design and evaluate opportunities for improved building energy performance, indoor air quality and workers thermal environment;
- Produce a list of building, process and system related measures for further consideration;
- Using simulation tools, screen the proposed technologies and measures for the appropriate performance and a pay-back period in several representative climatic conditions;
- Incorporate changes into standard design for the Technical Panel consideration;

Phase 2

- Select the site for a pilot testing and work with an A&E firm to adopt the proposed pilot “standard design” to specific site and climatic conditions;
- Provide technical assistance to the contractor when needed;
- Evaluate pilot building performance and report the results to the Technical Panel for its consideration on changes to be made in the final standard design.

Examples of Potential Measures Allowing for TEMF Building Performance Improvement

- Vehicle exhaust rails in the motor repair bays
- Welding fume exhausts in the welding bay mounted on the suspension beam with a flexible extraction arm
- Exhaust systems are sized for a partial load with a VFD, motorized dampers and pressure sensors allowing to match extraction rate with the process requirements
- VAV air supply system to production bays with a CO2 monitoring
- Heated floors with a zonal control
- Insulated folding or rapid-rolling doors
- Cold air curtains with a lobby (mild climates)
- Double air curtains (cold- + warm-air curtains) for cold climates
- Double-pain glazing with reflecting coating
- Combined exhaust from the administrative area with cooling/heating energy recovery to be used for supply air treatment

Standard Design can also include measures allowing for the building CBR protection and energy systems reliability

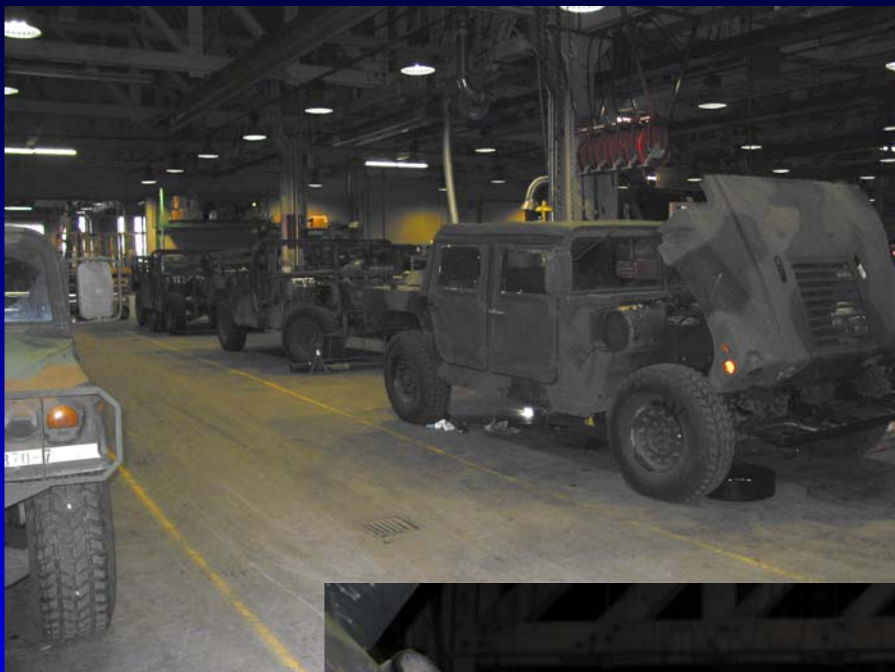
Potential for a SPiRiT Rating Increase Built-in the Standard Design

Sustainable Design Initiatives	SPiRiT Rating	
	1996 Standard Design	Proposed Standard Design
1. Optimized Energy Performance	?	20
2. IAQ monitoring		1
3. Increase Ventilation Effectiveness		1
4. Indoor Chemical and Pollutant Source Control		1
5. Controllability of Systems		1
6. Thermal Comfort		2
7. Holistic Delivery of Facility		2
8. Soldier and Workforce Productivity and Retention		3
Total		31

Standard Design SPiRiT rating can be increased by including provisions on O&M, M&V and Systems Commissioning.

Examples of energy saving technologies for TEMF, which may or may not be applicable for different sites (climatic, seismic conditions, etc.)

Examples 1. Building Air Pollution with Diesel Exhausts



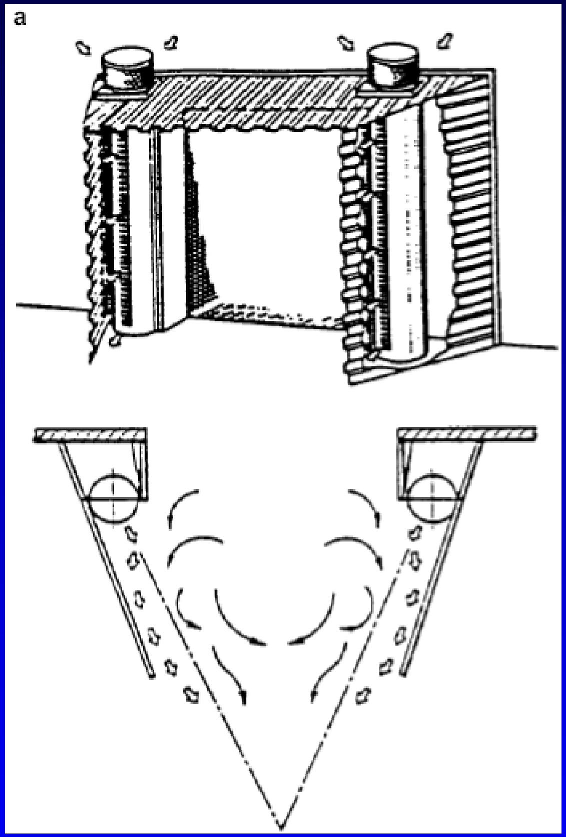
Solution: straight rail connected to vehicle exhausts

Example 2. Excessive heating/cooling loads due to un-insulated doors doors with no protection against cold/warm air drafts

Solution: Insulated doors e.g., rapid-roll doors and rapid-fold doors with foam infill for extra insulation

Pros.: Reduces heating/cooling loads on HVAC systems, better thermal environment in the building perimeter.

Solution: unheated air curtains with a lobby to prevent cold air drafts into the building



Solution: air-lock prevents cold air drafts into the building and allow to heat the vehicle prior to bringing it to the shop

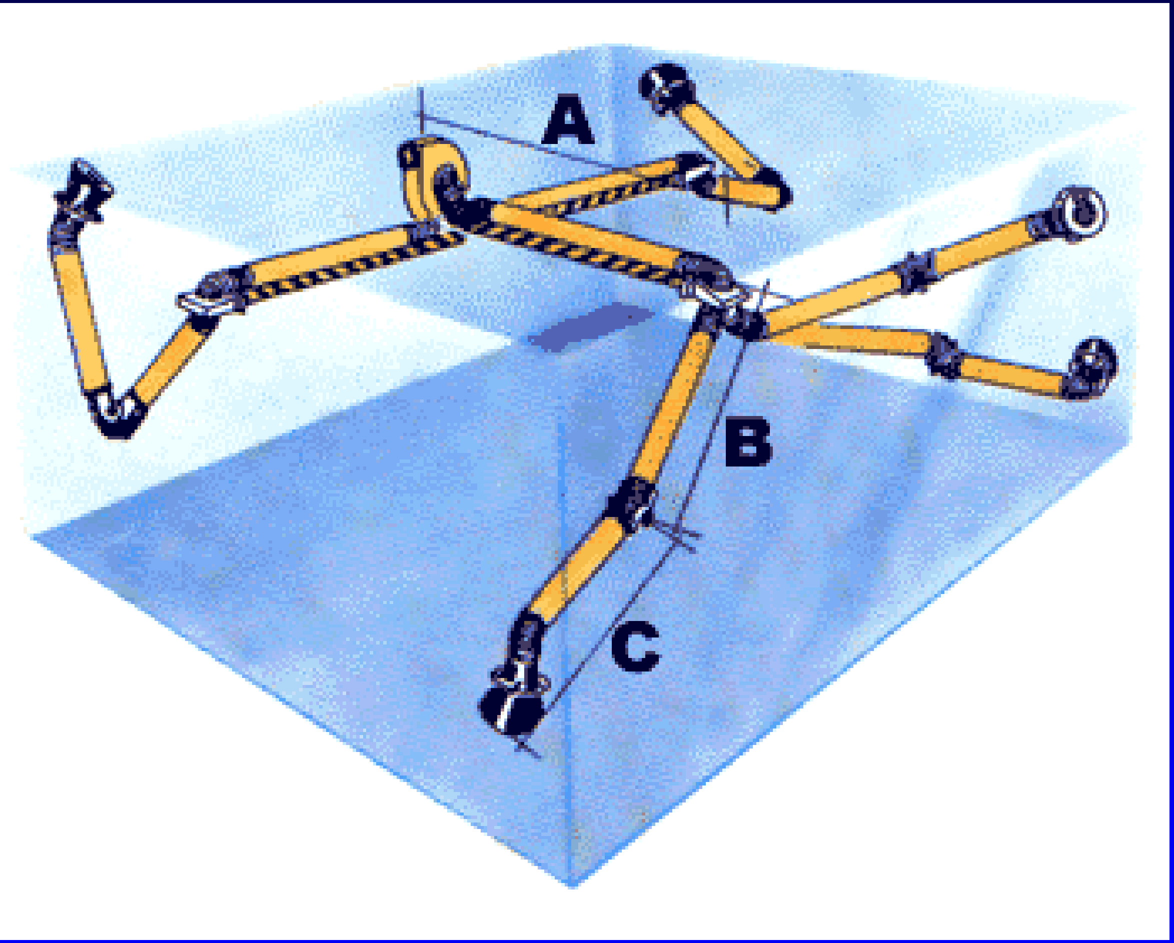
The building is protected from then outdoor air by two sequentially installed gates with an enclosed space (“air lock”). There is only one gate open at a time to let a vehicle in or out the building. After the vehicle enters the “air lock” the first gate closes and the second one opens.

Example 3. Solution: Air Distribution Strategies

Air Supply into motor repair bays though round nozzles into the isles between vehicles.
Pros. : minimizes poor ventilated areas, high induction, VAV capability, no temperature gradient, low first cost.

Air supply into welding area through perforated diffusers.
Pros.: high ventilation efficiency, creates temperature and contaminant gradient

Example 4. Solution: welding fumes extraction for large welded pieces

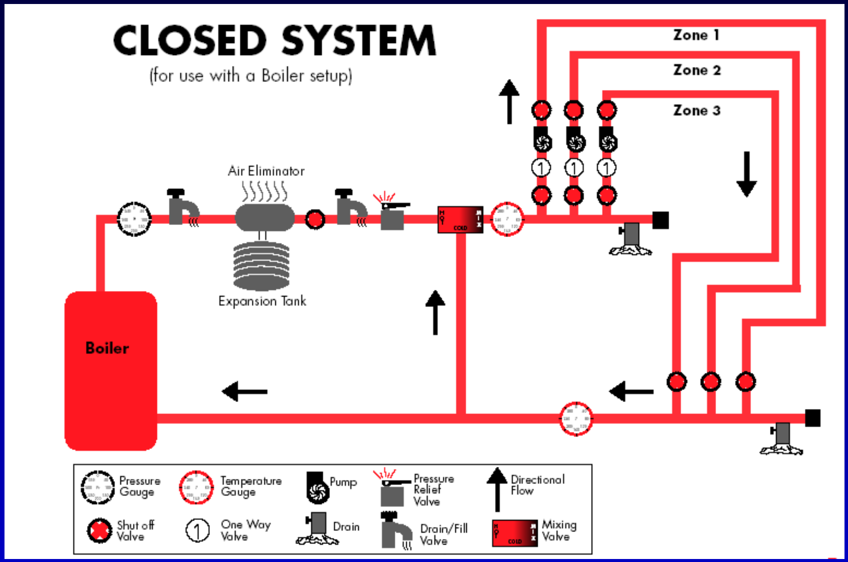


Example 5. Conventional heating systems

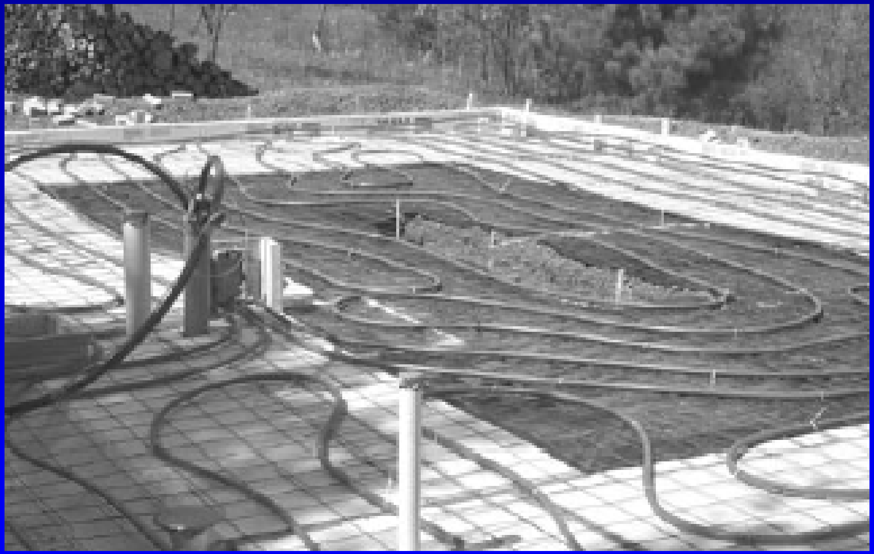
Cons. Doesn't heat floor under the vehicle.
Low efficiency due to the loss of heat convective component

Cons. Requires time to heat the space after doors have been open
Cold floors make soldiers work under vehicles uncomfortable.
Low efficient due to temperature stratification along the height

Solution: radiant floor heating system



- 30-40% more efficient compared to forced warm air system
- Provides thermal comfort for soldiers working
- under vehicles
- Better thermal conditions with doors open and immediately after doors closing
- Equipment cost ~ $0.75/ft2
- Zonal control of heat supplied to each bay



Questions, Comments??

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